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Effective Date 3-9-92

TITLE: RECOMMENDED PROCEDURES FOR DRILLING SMALL DIAMETER BOREHOLES

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SNL Safety Approval: G. Munkin Date: 3-2-92  
MOC Cognizant Department Manager Concurrence: [Signature] Date: 3-2-92  
MOC Manager of Safety and Plant Protection Concurrence: H.R. [Signature] Date: 3-6-92  
SNL QA Approval: James [Signature] Date: 3-9-92

**PURPOSE:** The purpose of this procedure is to provide a general recommended method for drilling holes in the size range smaller than 16 inches in diameter.

**RESPONSIBILITY:** It is the responsibility of all concerned personnel to be thoroughly familiar with the forms, procedures and SNL QA requirements pertaining to the task being performed. Only personnel qualified through the MOC training process will operate the drill equipment.

**SAFETY:** Safety shall be the main concern on all drilling operations. MSHA regulations regarding underground drilling shall be adhered to. All drilling equipment shall be maintained in good working condition and be of adequate size and strength to perform the drilling tasks. Equipment shall be inspected prior to use. Operators and helpers shall be aware of potential danger of getting caught in rotating equipment. Loose fitting clothing shall be avoided when operating or working around a drill. When handling drill rod, pipe wrenches, large core barrels, large core or any heavy objects care will be taken to avoid crushing type injuries. Do not place hands or feet beneath core or core barrel when they are suspended. Only qualified operators shall operate drilling equipment. In the case of training, a qualified operator shall be present when drilling equipment is being operated by a trainee. Ground control shall be carried out prior to work starting. External electrical grounds will be attached to the

Longyear EHS-38 or DIAMEC 230 drills and the dust vacuums, if the use of this equipment is required. Whip checks shall be attached to all air hoses. When working in dead ends, air quality shall be checked prior to work commencement. All personnel shall wear hearing protection while drill is being operated. Dust masks shall be worn if necessary. Vacuums shall be used for dust control whenever possible.

REFERENCES:

- I. Operating Instructions for Diamond Core Drill DIAMEC 230
- II. 65 Diamond Core Drill Operator/Service Manual
- III. Operating Instructions for Longyear EHS-38 Diamond Core Drill
- IV. Procedure 92, Initial Drilling and Logging of Core Samples, latest revision
- V. Procedure 140, Underground Drilling Request and Hole Identification System, latest revision
- VI. WIPP Safety Manual WP12-1, latest revision
- VII. SNL WIPP Procedure 263, Sample Tracking System, latest revision

FORMS

SNL WIPP FORMS, latest revision

- I. Title: DRILLING LOG (No. 36)
- II. Title: CORE DRILLING DATA (No. 37)
- III. Title: RECORING DATA (No. 47)
- IV. Title: DRILLING/CORE REQUEST (No. 118)
- V. Title: SAMPLE TRACKING DATA (No. 126)

PROCEDURE:

- I. Previous to drilling, the hole location shall have been tagged with an approved hole designation and surveyed if required. Drilling personnel shall have in their possession a Drilling/Core Request. This form shall contain all pertinent information and be signed by the SNL Site Supervisor and Concurring PI if applicable.

- II. Depending on the hole requirements (diameter, length, tolerance, wall smoothness, etc.) the appropriate drill bit is selected. In general carbide drag bits and rollercone bits are used for smaller diameter holes which do not have tight tolerance requirements. Diamond bits are preferred where diameter tolerance is tight or when a smooth borehole wall is specified. Coring type bits are used any time core is required.
- III. Drill selection is also dependent on several criteria. Three drills are available: The Longyear EHS 38, Longyear D-65, and the DIAMEC 230. Unless a specific drill is requested it will be left to the qualified driller to choose the machine which they feel will perform the task in the most efficient manner.
- IV. Selected drill is aligned over hole locations. If the hole is vertical up or down a bubble level is used to set the drill angle. When a specified angle is requested a front sight and back sight will be surveyed in. A line will be run between the two sights and through the spindle of the selected drill. Center this line in the spindle or quill. Properly anchor drill and recheck alignment, adjust if necessary.
- V. Determine proper drill rod for size of hole and insert through spindle or quill. As a general rule the diameter of the drill rod shall be as close to the diameter of the hole being drilled as possible. When drilling holes of greater diameter than the drill rod available it may be necessary to use stabilizers. A stabilizer close to the diameter of the drill hole is placed into the drill string to minimize rod whip and vibration. Attach previously selected bit. Larger size drill rod may not fit through the quill and will have to be added ahead of the chuck.
- VI. Some bits may require a starting template to start hole. If this is necessary anchor template to rock surface. Generally holes will be started at a low RPM and the RPM's will gradually be increased as the bit penetrates the rock surface. Once the bit is below the surface the RPM's and the feed pressure are adjusted and monitored by the drill operator. The operator shall keep vibration of the drill string to a minimum. Differing rock conditions may require the drilling method to be altered to produce the intended results. Because of the variables involved there can be no set rules for drilling rates, it will be up to the operator to decide what works best. When in doubt contact the Sandia technical advisor for drilling or the PI for whom the holes are being drilled.

- VII. When air is the circulating fluid, limit dust emissions when possible by use of a stuffing box and vacuum. This is accomplished, under standard operating mode, by directing the effluent from the stuffing box to the vacuum. Air circulation pressure will be regulated to adequately remove the drill cuttings. As the hole depth increases, air pressure can be adjusted upward to compensate for the increased air flow resistance. When drilling with reverse circulation, the vacuum will be connected to the drill swivel and a compressed air line will be attached to the stuffing box. The compressed air flow can be regulated to optimize drilling efficiency and minimize creation of airborne dust.
- VIII. When drilling with brine, a collar must first be installed. If coring, drill to a depth sufficient to allow insertion of the core barrel assembly using air circulation when necessary. Insert the core barrel assembly or the bit into stuffing box or hole and tighten the stuffing box/drill rod packing to sufficiently contain circulation pressure. This may need adjustment once drilling is started. Start the brine circulation by engaging the circulation pump. Check at the brine reservoir to ensure adequate return. Start the drilling/coring process. When a coring run is completed stop the drill. Turn off the circulation. For core recovery break the drill string above the stuffing box. Core can now be removed by either the wireline latch system for wireline drill operations or manually by tripping the drill rod. Continue the drilling/core retrieval process until the desired hole depth is achieved.
- IX. When core is required SNL WIPP Procedure No. 092, Initial Drilling and Logging of Core Samples, will be followed. Any special instructions for handling or storing the core shall be noted on the drilling/core request. There is a wide variety of core barrels available for taking core. Experience has shown the percentage of core recovered is greater with larger diameter core. When core recovery is important a thin walled coring bit which produces 3 inch diameter core or larger will generally be used.

DOCUMENTATION:

- I. The appropriate QA forms will be completed for each borehole drilled. For holes that do not require core to be taken the form titled Drilling Log will be completed, approved and turned in to SNL QA representative. For holes requiring core the form titled Core Drilling Data will be completed, approved and turned in to SNL QA representative. When producing core from an existing core the form titled Recoring Data will be completed, approved and turned in to SNL QA representative. These forms shall be filled out as completely as possible. A comment section is included for documenting any unusual occurrences during drilling. All drilling logs will be approved by Sandia's technical advisor for drilling.

### REVISION SUMMARY

To be completed by procedure's author before final revision is circulated for signatures.

I. Revisions made: Added steps about use of  
circulation fluids

II. Personnel effected:  
(Check appropriate ones)

MOC Craftsman

Drilling	<u>X</u>
Shop	<u>      </u>
Mechanical	<u>      </u>
Electrical	<u>      </u>
Gage	<u>      </u>
Cable/TC	<u>      </u>
U/G DAS	<u>      </u>
Geotech	<u>      </u>

SNL JOB AREAS

DAS General	<u>      </u>
DAS B49 Trailer	<u>      </u>
DAS Sheds	<u>      </u>
DAS Equip. Cal. & Inv.	<u>      </u>
Thermocouple	<u>      </u>
Cables	<u>      </u>
Drilling	<u>X</u>
Gage Installation	<u>      </u>
Gage Cal. & Removal	<u>      </u>
Plugging & Sealing	<u>      </u>
Brine Transport	<u>      </u>
General	<u>      </u>

III. Retraining required:  
(Circle one)

Read Re-read procedure

Practical demonstration

Other (explain)

Signature of

Procedure's Author W.D. Payne for Angus Robb Date 2/26/92